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ABSTRACT

A study was designed to examine the relationship between certain measures of cognitive development and reading scores, particularly reading comprehension scores. Forty-one adult basic education students, ranging from 16 to 62 years of age (mean age of 25) and predominantly from lower socioeconomic groups, were administered the following three instruments, used to measure reading comprehension, level of logical judgment, and conservation of linguistic structure, respectively: The California Achievement Test; Peel's test of logical judgment (in which a paragraph was read to the subject, followed by two questions; subject's response was then rated according to coordination of information and data source); and Hutson's instrument consisting of eight pairs of sentences (which varied in terms of probability of occurrence and in terms of similarity and dissimilarity of meaning) in which the subject was asked to judge the equivalence or nonequivalence of paired sentences. Major findings revealed (1) that adults do function at different levels of logical judgment and that the functioning level is independent of the adult's reading achievement score, (2) the validity of Peel's concept of levels of logical judgment is supported, and (3) the two variables, linguistic conservation ability and reading level, are significantly related in adult populations. (SH)

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LEVELS OF ABSTRACTION AND THE ADULT READER

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The Problem

One of the major paradoxes in reading instruction in Adult Education is that of the illiterate adult coming to the learning situation with years of accumulated experience and knowledge. The adult learner's ability to function at high levels of cognitive ability within a particular domain seems to be inconsistent with his low measured reading level. The dilemma for adult educators is that so little information is currently available related to cognitive complexity and reading achievement that it is impossible to reconcile these two seemingly conflicting, yet co-existing, realities. Yet, the issue of cognitive complexity continues to make its uncomfortable presence felt in adult education classes. Teachers of adults often find learners who do well in decoding and literal comprehension, but who have difficulty getting past the fourth or fifth grade reading level where there is increasing demand for inferential and interpretive comprehension skills. While certain demographic characteristics of the adult may account for a portion of this difficulty, it appears that it is also related to his level of cognitive functioning.

The focus of this study was the relationship between certain measures of cognitive development and reading scores, particulary reading comprehension scores. The intent of this examination was to shed some light on this confusing and essentially uncharted area of research in adult education.

The Nature of Cognitive Complexity

Cognitive complexity, as developed by Kelley and modified by Bieri, discriminates learners who are more or less complex in structuring perceptions of their world. This characteristic may be related to individual differences underlying the ability of ABE students to comprehend at literal, inferential, and creative levels.

Research from the Piagetian viewpoint validates this notion of variance among adults in cognitive complexity. Recent Piagetian studies find that there are individual and group differences among adults in cognitive development. These studies point out that adults differ in their ability to perceive structural relationships among facts in a passage. These results indicate that reading comprehension on higher levels is not a function of word-level units, the basis for most reading instruction, but of the explicit or implicit relationships among these "units" or facts. Again, the relevance of cognitive complexity is substantiated.

Peel, a British scholar, has extended and further developed this area of study. Peel, focusing on the application of concepts of cognitive development in subject matter areas, analyzed the responses of adolescents and adults to simple questions following a short anecdote. Peel was not interested in assessing comprehension per se, rather his concern was how his subjects related the facts given to make judgments. By studying the responses given, Peel developed a classification system which linked the sophistication of the subject's logical judgment aptitude with his level of comprehension. Peel's classification grid looks like this:

Logical Judgment	Comprehension
Irrelevant or distorted	Word-calling only
Bases judgment on 1 fact, ignores conflicting information	Literal
Bases judgment on 2 or more facts	Inferential
Goes beyond the facts to relate them to his other knowledge	Creative

Peel's interest plainly rested not in the response but in its logical foundation, or in the cognitive processes which the respondent utilized to arrive at his response.

Another area of cognitive research which has relevance for adult educators is the study of linguistic structure. Utilizing the rationale developed by Piaget, this research has focused on the concept of conservation of linguistic structure or the ability to recognize semantic equivalence or non-equivalence. Hutson (1976) designed procedures to assess conservation of linguistic structure utilizing using sentence pairs containing active and passive tense verbs. The sentences varied in terms of their probability of occurrence and in terms of their similarity and dissimilarity. The intent of Hutson's instrument was to gain a measure of the subject's ability to conserve linguistic structure which was assumed to be related to his simple logical concepts about language structure.

In sum, the area of cognitive complexity has been examined from several perspectives. The points of view which seem to have the greatest relevance to reading comprehension and the adult learner stress logical development. Both Peel's work on the relationship between logical judgment and comprehension and Hutson's research on the logical concepts of linguistic structure seem to have special relevance for adults.

Purpose of This Study

This study sought to use both Peel's and Hutson's instrumentation to further examine the impact of an adult's cognitive level on general reading achievement. Rather than tackling the whole issue of cognitive complexity, the study limited its concern to the sub-units of logical development and the logical concepts of linguistic structure. Specifically, the objectives of the study were to examine:

(1) the utility and feasibility of Peel's tests of logical judgment with adult basic education students,

(2) the relationship of the measure of logical judgment to measures of reading level, especially reading comprehension level,

(3) the relationship of the measure of conservation of linguistic structure as developed by Hutson to reading level, and

(4) the relationship of the logical development and reading achievement variables to various demographic variables including age, sex, ethnic group, and number of years of schooling prior to entering the program.

Methodology

The forty-one subjects were adult education students in an adult basic education center. They ranged in age from 16 to 62, with a mean age of 25, and they were predominantly of lower socio-economic status. The majority of the subjects were males (30) and of Caucasian origin (25). There were eleven Black subjects. The reading levels of the subjects ranged from non-reader to 13-0, with a mean reading level of 7-1.

Three separate instruments were used to measure reading comprehension, level of logical judgment and conservation of linguistic structure. In addition, the necessary demographic data was collected. Reading comprehension was measured using the appropriate sections of the California Achievement Test.

Peel's instrument was modified slightly to assess the level of logical jusgment. The paragraphs in his instrument were edited to delete references and spellings peculiar to Great Britain, and the scoring system was changed to a more specific procedure which enhanced inter-rater reliability. Peel's basic procedural format of reading the paragraph to each subject, followed by two questions was, however, maintained. Subject responses were rated on two dimensions, coordination of information and data source. Each response was rated 0-3 based on the following criteria:

I. Coordination of Information

0 - Supports neither position with relevant evidence or arguments.

1 - Supports one position with relevant arguments.

2 - Supports both sides with some relevant evidence, but does not coordinate them, or states that the answer cannot be determined.

3 - Resolves contradiction with relevant evidence, or specifies why the answer cannot be determined.

II. Data Source Used

0 - Uses only irrelevant facts or none: or essentially restates the question.

1 - Uses facts from the story or inferences which are little more than paraphrases or simple associations or cliches.

2 - Goes beyond the facts of the story with inferences which are related to facts but extend beyone the facts given.

3 - Analyzes the paragraph to note irrelevancies or missing data.

The instrument includes seven passages, and subject responses are scored separately on each dimension for each passage.

Hutson's instrument was used to assess linguistic conservation. Subjects were asked to judge the equivalence or non-equivalence of two sentences, one of the active voice and one of the passive voice. In addition, subjects were required to provide a justification for their response. Hutson's instrument consists of eight pairs of sentences which varied in terms of probability of occurrence (The baby was washed by the mother./ The mother was washed by the baby.) and in terms of similarity and dissimilarity of meaning. Subjects were given two scores, one for correctness of response and one for correctness of justification. With eight pairs of sentences, a subject's total score in each area could range from 0-8.

Results

The results of study are organized in terms of:

(1) the means, distributions, and other relevant characteristics of subject performance on the modified Peel instrument, the Hutson instrument, and the California Achievement Test.

(2) the inter-relationships of each pair of these variables:

(a) level of logical judgment and reading achievement,

(b) level of logical judgment and linguistic conservation, and

(c) linguistic conservation and reading achievement

(3) the inter-relationships among the above three variables and the demographic data collected.

I. Subject Performance on Instruments

A. Level of logical judgment

The mean ratings for subjects on level of logical judgments for each of Pool's seven passages was 1.52 (rater 1) and 1.54 (rater 2) of a possible 3.00 for Coordination of Information and 1.70 (rater 1) and 1.74 (rater 2) of a possible 3.00 for Data Source used (Table 1). The standard deviations (Table 2) ranged from 0.6 to 0.9 for most ratings on most stories.

Examination of the frequency distributions (Table 3) for ratings confirms and clarifies the picture presented by the means. For Coordination of Information, there were very few subjects rated as Level 0 (supports neither position with relevant evidence or arguments), a large proportion rated as Level 1 (supports one side) and a few at Levels 2 and 3. For Data Source Used there were again few Level 0 responses (uses only irrelevant facts), but there were approximately the same number at Levels 1 and 2, and a few responses at Level 3.

Raters indicated that while scoring responses required some thought that the procedures were adequate and acceptable. Relatively high inter-rater reliability scores (.92 and .88) adds validity to the rater's positive judgment toward the feasibility of scoring responses accurately.

B. Degree of linguistic conservation

The means for conservation of linguistic structure for the sample population were 6.6 out of a possible 8.0 for correctness of response and 5.6 out of a possible 8.0 for correctness of justification. This is comparable to

TABLE 1

Mean Ratings for Level of Logical Judgments

Story	Mean Ratings: Scale 1 Coordination, Rater 1	Scale 1 Coordination, Rater 2	Scale 2 Data Source, Rater 1	Scale 2 Data Source, Rater 2
1. Skating	1.49	1.51	1.77	1.81
2. Lynn	1.42	1.44	1.74	1.93
3. Sisters	1.44	1.42	1.65	1.65
4. Jane	1.26	1.23	1.72	1.63
5. Tall Buildings	1.72	1.72	1.84	1.86
6. Runner	1.77	1.77	1.54	1.61
7. Pilot	1.54	1.70	1.65	1.72

TABLE 2

	Standard Deviations of Mean Ratings for Level of Logical Judgment			
1. Skating	0.70	0.77	0.84	0.82
2. Lynn	0.82	0.83	0.69	0.74
3. Sisters	0.80	0.76	0.57	0.53
4. Jane	0.82	0.78	0.70	0.66
5. Tall Buildings	0.88	0.91	0.62	0.60
6. Runner	0.92	0.95	0.80	0.90
7. Pilot	1.01	1.01	0.84	0.91

TABLE 3

Frequency of Various Ratings
for Level of Logical Judgments

		Coordination Level				Data Source Level			
		0	1	2	3	0	1	2	3
Skating	Rater 1	1	24	14	4	1	13	14	10
	Rater 2	1	25	11	6	1	16	16	10
Pilot	Rater 1	5	21	6	11	2	19	14	8
	Rater 2	4	18	8	13	3	16	14	10
Runner	Rater 1	0	24	5	14	1	25	10	7
	Rater 2	1	22	6	14	2	22	8	10
Tall Buildings	Rater 1	0	24	7	12	1	9	29	4
	Rater 2	0	25	5	13	1	8	30	4
Jane	Rater 1	6	24	9	4	1	15	22	5
	Rater 2	5	27	7	4	1	17	22	3
Sisters	Rater 1	1	29	6	7	0	17	24	2
	Rater 2	1	29	7	6	0	16	26	1
Lynn	Rater 1	2	28	6	7	0	17	20	6
	Rater 2	1	30	4	8	0	13	20	10
Co-ordination	average	2	25	7.2	8.8	1	164	192	6.4
Data Source	average	5%	61%	18%	21%	2%	40%	47%	16%

the pattern previously found by Hutson for fifth graders. When the subject population was classified according to their overall reading level on the California Achievement Test (Primary, Intermediate, Secondary) the means for linguistic conservation were found to co-vary with reading level (Table 4).

C. Reading comprehension level

The initial mean for total group on Total Reading scores on the California Achievement Test was 6.4 and the final reading score for the same subjects, after varying lengths of instructional contact, was 7.5 (Table 4). The majority of subjects (26) were classified in the intermediate (4.1-8.0) reading level, with only five subjects classified on the primary (0-4.0) level and the ten subjects classified on the secondary level (8.1-14.0).

II. The Inter-relationships of Variables Assessed

As can be seen in Table 5, there were a number of significant inter-correlations among the major variables of this study. Examining first the relationships between the linguistic conservation ratings and the other variables, one notes that the first indicator of linguistic conservation, correctness of response correlated significantly with the second indicator of linguistic conservation, correctness of justification, as well as with all measures of reading level (.49, .50, .47). The second indicator of linguistic conservation, linguistic justification, evinced similar correlation coefficients with all measures of reading level. In addition, subject scores on correctness of linguistic justification also correlated significantly (.36) with the data source dimension of the level of logical judgment measure.

Reading level measures included initial reading level achievement, final vocabulary achievement, and final comprehension achievement. As would be expected, all three measures correlated rather highly (.79, .76, .77) with one another, however, none of the reading scores correlated significantly with either level of logical judgment dimention.

TABLE 4

Comparison of Mean Scores in Reading and Linguistic Conservation for Adults Categorized in Terms of Their Reading Levels

Grade equivalents	Primary (0-4.0)	Intermediate (4.1-8.0)	Secondary (8.1-14.0)	Total (0-14.0)
n=	(5)	(26)	(10)	(41)
Initial Reading Level	0.60	6.01	10.10	6.35
Final Reading Level	4.36	6.81	10.92	7.52
Linguistic Response	5.00	6.69	7.00	6.56
Linguistic Justification	3.60	5.73	6.30	5.61

TABLE 5

Correlations Among Linguistic Conservation, Achievement, and level of Logical Judgments

Linguistic Conservation	1	2	3	4	5	6	7
1. Linguistic Response	1.00	.84**	.49**	.50**	.47**	.26	.29
2. Linguistic Justification		1.00	.48**	.44**	.51**	.29	.36*
Reading Level							
3. Initial Reading Achievement			1.00	.79**	.76**	.15	.16
4. Final Vocabulary Achievement				1.00	.77**	.18	.17
5. Final Comprehension Achievement					1.00	.07	.11
Level of Logical Judgment							
6. Logical Coordination						1.00	.90**
7. Logical Source of Data							1.00

n = 41 * p < .05 ** p < .01

Subjects' level of logical judgment scores on the two dimensions coordination of information and data source used, correlated highly (.90). Yet, there was only one other significant correlation between level of logical judgment and the other assessed variables. This correlation, r=.36, was found for the correctness of justification measure of linguistic conservation.

In summary then, it appeared that the measures of linguistic conservation and reading level were related. The measures of level of logical judgment seemed, on the other hand, to be independent of all other variables with the exception of the measure of linguistic justification.

III. Demographic Data Correlations with Other Variables

The correlations between the demographic variables and the assessed measures of logical development were largely insignificant (Table 6). The age variable, however, correlated significantly negatively with the two measures of linguistic conservation (r= -.39, -.41) indicating that the older subjects were less likely than the younger ones to be able to detect semantic equivalence and non-equivalence. The age variable also correlated negatively (r= -.49, -.31, -.35) with all the measures of reading level. The author believes that this correlation relationship was probably due to the peculiarity of the subject population and that it is not generalizable. The oldest subjects in this group tended to have had less prior exposure to education and to be functioning at lower academic levels, and as a group appeared less intellectually able than younger students. There were, of course, exceptions.

The insignificance of the correlations between the ethnic demographic variable and the measures of logical development suggests that the instruments used to assess logical development were not strongly biased in favor of one language.

TABLE 6

Correlation of Matrix for Major Variables and Demographic Variables

	1	2	3	4	5	6	7	8	9	10	11
	Sex	Age	Highest Prior Grade	Ethnic	Ling. Resp.	Ling. Justif.	Init. Rdng	Final Vocab.	Final Comp.	Logical Coord.	Logical Data Source
1. Sex	1.00										
2. Age	.03	1.00									
3. Highest Prior Grade	.13	- .73	1.00								
4. Ethnic	.19	- .03	.14	1.00							
5. Ling. Resp.	.10	- .39	.16	.04	1.00						
6. Ling. Justif.	- .27	- .43	.27	- .01	.84	1.00					
7. Init. Reading	- .14	- .49	.57	- .18	.49	.43	1.00				
8. Final Vocab.	.05	- .31	.37	- .07	.50	.40	.79	1.00			
9. Final Comp.	.19	- .35	.37	- .11	.47	.51	.76	.77	1.00		
10. Logical Coord.	.06	.16	- .18	.02	.26	.29	.15	.18	.07	1.00	
11. Logical Data Source	.02	.14	- .16	.01	.29	.36	.16	.17	.11	.90	1.00

Summary

The major findings of this study can be summarized as follows.

(1) The modified Peel instrument was shown to be feasible to use with adult basic education students.

(2) Adults were found to vary in their level of logical judgment as assessed by the modified Peel instrument.

(3) The data generated from the modified Peel instrument indicated that an adult's level of logical judgment was not related to his measured reading achievement level.

(4) Adults were found to vary in their ability to conserve linguistic structure.

(5) The degree to which an adult could conserve linguistic structure was found to co vary with his measured reading achievement level.

(6) The demographic variables of sex and ethnic group were not significantly correlated with any of the measures of logical development.

(7) The significant correlations found between age and certain of the studied variables were judged to be attributable to the peculiarity of the subject population and not to be generalizeable.

Implications of the Study

The implications of the study will be discussed in terms of the study's objectives as listed on pages 3 and 4.

The study's first and second objectives were concerned with determining the value of using Peel's instrument for assessing levels of logical judgment with adult basic education students. The data revealed that adults do function at different levels of logical judgment and that this functioning level is independent of the adults' reading achievement scores. This finding validates the feelings of many adult education teachers that their students' cognitive fun

functioning levels are not always related to their reading scores and that their reading levels are not good predictors of this functioning level.

This data indicates that level of logical judgment may be an overlooked discriminating characteristic of adult learners. Adult educators are often so inundated with the reading needs of their students, that they fail to notice their other cognitive strengths and weaknesses. Examination of the Peel instrument raises the possibility that its measure may more effectively assess the adult's actual ability to make decisions and judgments critical to effective functioning in the society than do standard academic achievement tests. The validation of this hypothesis would clarify the paradox noted at the beginning of this paper that illiterate adults often can function very adequately in their communities and families. In short, the findings of this study support the validity of Peel s concept of levels of logical judgment, and they suggest a need for further research in this area.

The study's third objective focused on the potential relationship between an adult's linguistic conservation ability and his reading level. The study found that these two variables were indeed significantly related. The relationship of linguistic conservation and reading achievement is especially worth noting because performances on the Linguistic Conservation instrument and on the California Achievement Test were not similar in stimulus and response characteristics. In the Linguistic Conservation task the sentence pairs were read to the students, while in the CAT the students read the materials to themselves. In addition, the types of responses varied from a closed multiple choice format on the CAT to an open-ended constructed response on the Linguistic Conservation instrument. Nonetheless, the two abilities, linguistic conservation and reading, seem to parallel one another in adult populations.